Will Global Warming Impact Eelgrass in the Pacific Northwest?

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Introduction

Seagrasses fringe the coasts throughout the tropics to the subarctic, where they comprise important habitat for a wide variety of marine species. A review by Short and Neckles (1999) indicated that seagrasses are vulnerable to climate variability for a variety of reasons including changes in temperature, sea level and salinity. We have found that climate variation affects the abundance and productivity of eelgrass; the most abundant seagrass in the Pacific Northwest. Although there are ample data showing that light attenuation through the water column affects eelgrass abundance along a depth gradient, less information is available illustrating spatial patterns in abundance forced by gradients in salinity and other factors. Least reported and understood is the inter-annual variability in eelgrass abundance, as well as the factors causing this variability. Our work since 1991 illustrates that eelgrass abundance can vary dramatically between years. Our studies in outer coast estuaries on the Pacific Northwest indicated that eelgrass abundance was very low in 1998 during the "El Niño of the century" and recovered dramatically during the subsequent La Niña in 1999-2001 (Thom et al. 2003). The purpose of this paper is to put forth some potential mechanisms causing inter-annual variation in eelgrass abundance.

Data Sets

We have three data sets illustrating variation in eelgrass abundance developed at three sites as shown in Table 1. The methods and results of the studies in Willapa Bay have been reported in Thom et al. (2003). Divers using 1.0m^2 quadrats in each site collected data on density at Clinton Ferry terminals. Growth rates at Sequim Bay were measured for 30 replicate shoots using a leaf-marking method over two-week periods during summer.

System	Data set	Period of measurement
Willapa Bay, six sites	Eelgrass density in summer	1998-2001
Clinton Ferry terminal, three sites	Eelgrass density in summer	1998-2004
Sequim Bay, one sites	Eelgrass growth rate in summer	1991-2004 (11 of 14 years)

Results and Conclusions

Willapa Bay eelgrass showed a three-fold increase in total abundance between 1998 and 2000 (Thom et al. 2003). This increase was attributed to cooler summer temperatures and warmer winter temperatures that developed after 1998. We also speculated that sea level, which can be up to 30cm higher during El Niño periods, might have affected light reaching the plants in 1997-98.

Eelgrass density at the Clinton system also showed a three-fold increase between 1998 and 2001. When plotted against the Oceanic Niño Index (ONI), the greatest densities occurred during "neutral" years, and the lowest densities during the coldest and warmest years. Finally, growth rates at Sequim Bay showed 6-fold differences between some years. The growth rates had significant correlations with the Pacific Decadal Oscillation index, the ONI, and mean sea level anomaly.

Studies conducted earlier by us show strong effects of depth and temperature on eelgrass density and growth. We concluded, based on these data sets, that eelgrass variations are best explained by variations in sea level and temperature, and that a warmer and dryer conditions would results in less eelgrass in the Northwest.

Literature Cited

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